



# Low-Angle Fires for MOUT

**F**ew FA doctrine and literature sources mention fire direction in military operations in urban terrain (MOUT). However, the fire direction procedures for determining intervening crests in the mountainous terrain of the Mojave Desert at the National Training Center (NTC), Fort Irwin, California, apply to buildings as intervening crests in a MOUT environment. In addition, the procedures for low-angle fire adapted from *FM 6-40*

*Tactics, Techniques and Procedures (TTP) for Field Artillery Manual Cannon Gunnery* apply to fire direction in MOUT as the preferred firing angle.

High-angle fires may be required to attack targets in built-up areas, but the probable error in range for high-angle fires found in the tabular firing tables (TFTs) is greater than for low-angle fires. In an urban environment, the difference between a few meters and 10 can lead to a round's impacting on an

unintended target. This increase in probable error should be considered when using mortars, which are high-angle weapons.

Low-angle fires will work in current MOUT training centers, villages, small towns and most cities whose buildings are three or less stories tall. However, high-angle fires may be the only option if the firing data for low-angle fires in cities with high buildings or skyscrapers indicates the structures will interfere with the projectile. Also, high-angle fires may be required to keep from hitting observers or other friendly troops positioned on top of buildings or other high points.

The fire direction officer (FDO) ensures fires clear intervening crests or buildings. Computing an executive officer's (XO's) minimum quadrant elevation (Min QE) solution offers one possibility; however, this method is based on the ascending branch of the trajectory and does not account for considerations as the round travels the entire length of the trajectory.

The steps outlined in the figure take the FDO through the process of determining any potential problems with his low-angle fires due to intervening crests or buildings. The steps must be followed for every position the howitzer occupies.

The procedures in the figure for low-angle fire are adapted for urban scenarios. Although urban areas are not new combat terrain, we have few MOUT TTP. We must tailor FA fire direction tactics, techniques and procedures for this environment.

1. After the howitzer occupies a position, the fire direction officer (FDO) analyzes the terrain for intervening buildings. If map spotting is not possible, then he needs information from the S2 on the height and grid of each building. This is a critical procedure because most maps do not have building altitudes.

If the S2 is unable to gather this information, then the ground forward observer (FO) reports obstruction data up through the chain of command until it reaches the artillery S2 or battalion FDO. Equally important, the observer must report his location with the correct altitude as he may be observing from an intervening building or crest.

2. Once the FDO determines the possible obstruction, the FDO determines the maximum altitude of the crest or building and computes the firing data to that point. (He determines the quadrant elevation, or QE, to the maximum altitude of the intervening building.)

3. The FDO adds the value of two Forks (Column 6, Table F of the Tabular Firing Table) to the QE determined in Step 2 to ensure the round-to-round variations (probable errors) will clear this point.

4. The FDO then records this quadrant and the round's charge on his situational map (SIT MAP) as a check to ensure rounds will clear the intervening buildings.

5. If variable time (VT) fuzes are to be fired, the FDO must take additional steps to ensure the VT fuze does not arm before passing over the building and detonate due to reflected energy from the building. The VT fuze is designed to arm 3.0 seconds before the set time. It can, however, arm up to 5.5 seconds before the set time. The FDO must apply an additional interval of 70 meters to ensure that if the round is armed before passing over the building, it does not acquire any reflected radar energy. The FDO must identify the appropriate vertical interval (VI) based on these conditions. This is the "VT VI." After determining the VT VI, the FDO proceeds through the following steps:

- (a) Determine the armed VT QE using VT VI and range-to-crest.
- (b) Determine the time-of-flight (TOF) to the crest.
- (c) Add 5.5 seconds to the TOF from Step B and express this value up to the next whole second.
- (d) Record both the armed VT QE and minimum fuze setting for the VT fuze on his SIT MAP.

Computing Firing Data for Low-Angle Fires with Intervening Crests/Buildings and Using Variable Time (VT) Fuzes. (Procedures are adapted from *FM 6-40 Tactics, Techniques and Procedures for Field Artillery Manual Cannon Gunnery*, "Safety," Chapter 15, Paragraph 15-30.)

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